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CHILDREN'S DEPARTMENT

IN CHARGE OF
LOUISE C. BRENT

INFANT FEEDING

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THE physiology of infant and early life is of special interest, and the study of it of the greatest importance. The wonderful activity of the tissues in the first years has no parallel in the succeeding years.

We are told that the average healthy infant will add to his bulk at the rate of one ounce a day for the first three months, and half that amount a day for the next six. That is, he more than doubles his weight in the first six months.

I instance this wonderful rapidity of growth because I wish to direct attention to the paramount importance of the nutritive supply at this period of life. Recognizing the importance of a full supply of food, it must be provided in the form that will permit of its being assimilated and utilized in the process of living and in the building up of the body of the child. To accomplish this we must know something about the digestive and assimilative functions of the child. Failing such knowledge, we are apt to transgress woefully. Examples of such transgressions may be found in the many proprietary foods so widely advertised.

Reserving for later consideration the subject of infant digestion, let us answer the question so often asked, what is the best food for the infant? To this there can be but one answer,—its mother's breast.

The decision to abandon the mother's breast for an artificial food is fraught with the greatest importance to the infant. No matter how well the artificial food may be managed, the child's chances of survival are greatly lessened by the change. Taking a child from its mother's breast is a step that should be well considered and never determined upon until every effort has been made to modify and render suitable the mother's milk. In many cases the change is made on the slightest pretext. Some-

times it is determined upon from mere caprice, artificial feeding being considered more convenient. A greater mistake can hardly be imagined. To supply a correct food means incessant care. Digestive disturbance and a crying child are the result of every mistake or failure to be exact in preparation.

Apart from well-recognized conditions,—*e.g.*, the mother with phthisis or incurable disease and where pregnancy supervenes,—every effort should be used to secure a suitable food from the mother's breast.

The breast secretion may be defective from many causes.

After the first few days the average healthy secretion will give the following analysis. It will be found to consist chiefly of water with a small proportion of each of the four great classes into which all food may be divided,—albumins, fats, sugars, and salts :

Water, eighty-eight per cent. ; albumins, one to two per cent. ; fats, three to four per cent. ; sugars, six to seven per cent. ; salts, a trace.

During the early days of secretion the milk is richer in fats and has some purgative properties. Hence it is well to put the child to the breast at once, that this purgative milk may cleanse the intestines.

There are other features about the breast secretion which we shall have occasion to refer to later when we come to the consideration of artificial food,—that it is sterile, is secreted without vacuum at a temperature of 98.4° , etc.

A common mistake consists in undue frequency of nursing. The rule from the first month should be, every two hours between the hours of six A.M. to ten P.M. and once at night. One often finds that the child nurses whenever he cries during the day and practically all night. It becomes impossible for him to digest the milk he has taken, hence he has abdominal discomfort, which sensation he mistakes for hunger and cries for more. Besides this, constant resort to the mother's breast leads to the production of unduly concentrated milk difficult of digestion. Such milk will be found to contain an excessive quantity of albumin.

This brings us to the next difficulty.

It will be found that many cases of infantile indigestion are due to excess of albumin. The periods of feeding are properly arranged, yet the high albumin percentage continues. This may be due to an insufficient fluid supply in the food of the mother, the excess of albumin being relative. In many instances it is due to deficient exercise. The defect may be overcome by out-door exercise, walks, household duties, etc. A regular life and the avoidance of excitement and dissipation, together with a rather generous mixed diet with excess in the way of fluids, gives the best results.

Again, in many instances the child does not thrive on its mother's milk, not because of indigestion, as in the case of excessive albumin, but because of the constipating tendencies of the mother's milk. This condition may in many instances be attributed to a deficiency in fat. A change in the mother's diet may alter the character of the milk so as to relieve the condition.

From a study of the physiology of milk secretion we know that the fat of milk is increased by proteid food, but not increased, on the contrary diminished, by fatty food. Hence in cases such as I have described, where there is no disturbance of digestion but simply failure of nutrition, with perhaps constipation, the obvious treatment is to increase largely the albuminous substances of the mother's food. She should take in sufficient quantity meat, eggs, milk, etc. The same regimen will likely increase the amount of sugar in the milk. Sugar, like the fat, is a result of metabolism in the lactiferous cells of the breast, and is maintained quite independently of the ingestion of sugar or starchy food.

We have been considering cases in which the mother's milk was sufficient in quantity but unsuitable in quality. The defects usually met with being that it is indigestible, owing to excess of albumin, and insufficiently nutritious as a result of the low percentage of fat and sugar.

Let us turn now to cases of another kind, where the difficulty is with regard to the quantity and not the quality. There are many cases, more particularly among the higher classes, where the mother's milk is, while digestible, altogether insufficient in quantity. Much can be done to augment the secretion by more generous living, fluids, out-door life with exercise, etc. That is, everything should be done to improve the general nutrition of the body. While improvement may occur, yet there are still many cases where the flow remains quite insufficient to nourish the child, and in others the supply ceases altogether. In these cases resort must be had to an artificial supply. It must be remembered, though, providing the mother's milk agrees, that the more of it the child can have the better. It is a great mistake to put the child on an artificial food because his mother can only furnish a half supply. Much better to continue the half supply and supplement it by giving milk modified to suit his digestion in the way we shall presently describe.

Before leaving this part of the subject I would again urge the importance of giving the child all that can be secured of its mother's milk. The older he is before he is taken from the mother's breast, the better his digestive organs will be fitted to encounter the difficulties and vicissitudes of artificial feeding. A start of two or three months' entire or partial nursing is of the greatest benefit.

There are, however, many cases in which every effort fails and other

supply must be secured. The more carefully one tries to modify and adapt the mother's milk, the rarer these instances become.

A change from the mother's breast being decided upon, how shall we proceed to furnish the infant with a suitable food? The best results have followed efforts to so modify cow's milk that it closely resembles the normal secretion from the mother's breast. Not only must the milk be made to resemble the mother's milk, but it must also be given to the child under conditions as closely parallel as possible to those that surround the process of nursing. Due regard must be given to the requirements of the infant and his capacity of digestion. There are thus three problems set before us.

Let us consider the first, and at the outset note the points of difference between cow's milk and the mother's milk.

Compare analyses:

	Water, per cent.	Reaction.	Albumin, per cent.	Fat, per cent.	Sugar, per cent.	Salts.	Starch.
Mother's Milk . . .	88	Alkaline.	1 to 2	3 to 4	7	Trace.	None.
Cow's Milk	87	Acid.	4	4	4½	Trace.	None.

Cow's milk shows a great excess of albumin, more than twice the amount in mother's milk.

We have been discussing excessive albumin in the mother's milk as the cause of indigestion. Clearly the infant cannot digest three to four per cent. of albumin. This excess must be corrected in some way. The fat in cow's milk, if of good quality, may be about the same, three to four per cent.

Sugar in cow's milk falls below, being but four and five-tenths as compared with the breast secretion of seven per cent. sugar.

Testing with litmus paper shows the mother's milk to be alkaline, whereas cow's milk is slightly acid.

The first care must be to reduce the percentage of albumin by diluting the milk with water. This process, while it secures the albumin in the requisite percentage, brings the fat and sugar far below what is required. It becomes necessary, therefore, after having diluted the milk and so reduced the albumin, to make up again the deficiency in fat and sugar. This can be done by the addition of cream and milk-sugar.

Following certain rules laid down by experimenters in this field, we can so modify in this way cow's milk that it will furnish on analysis

about one to two per cent. of albumin, three to four per cent. of fat, and seven per cent. of sugar.

Dilution with water not only reduces the percentage of albumin, but it also brings about a change in the formation of curd in cow's milk, rendering it similar to that forming in mother's milk. Instead of curdling in large masses in the ordinary way, it is found that after dilution with five times the volume of water the curd now forms in minute particles imperceptible to the eye similar to the curd of mother's milk. Meig's mixture of cream, milk, and water is a very well-known and useful formula. The cream used is the twenty per cent. fat from a centrifugal machine, or if this cannot be secured I have advised the cream that would rise during the night from milk secured on the previous evening for that purpose.

The following mixture will give the analysis I have indicated:

Cream (twenty per cent. fat, or from milk set aside on the previous evening), 3 iii; milk, 3 ii; water, 3 x; milk-sugar, 3 iii.

In places remote from town the cream skimmed from the pan set by on the previous evening should be added to the milk secured in the morning. Sufficient should be made in the morning to last the entire day.

This cream mixture still lacks in two particulars the correspondence we are striving to secure with mother's milk. It is not sterile and it is acid in reaction. Mother's milk contains no bacteria except in case of disease such as phthisis or disease of the breast itself.

We can easily secure destruction of bacteria by heat. Instructions are, after making the mixture of cream, milk, water, and sugar, to put in a gem-jar or flask and immerse in a pot of boiling water for twenty minutes, the jar being loosely stoppered with absorbent cotton. The jar can now be securely sealed and the milk will remain sweet until used.

In this way one can no doubt get rid of the bacteria, but we are not so sure with reference to the chemical products the result of bacterial activity up to the period of sterilization. Obviously it is much better to secure milk which has been sterilized at once and which has been secured under the most favorable conditions with reference to cleanliness, both of the milkers and animals. Milk taken from a healthy animal after thorough washing of the milker's hands and the cow's udders will contain at the outset comparatively few bacteria, and if at once sterilized there has been little opportunity for bacterial development and those chemical changes which bacterial development implies. In country places these precautions can be observed with little difficulty. In town, fortunately, a great improvement has taken place with refer-

ence to the cleanliness of milk, but still some time must elapse between milking and the process of sterilization. In Toronto and in many large cities excellent work has been done in the establishment of dairy farms, which are the embodiment of the most recent ideas surrounding the problem of securing a milk supply free from danger of infection or defilement of any kind.

The benefit accruing from these model dairy farms is not limited to their own patrons, but extends to the entire community in lesser degree, for the reason that these establishments set the pace, as it were, and the interests of their competitors demand that they shall approximate to the same high standard.

A special feature of these milk laboratories is the furnishing of milk suitable for infants of any age. By a certain process they are able to furnish milk containing a given percentage of albumin, cream, etc. Prescriptions are received indicating the amount of each constituent desired. This is, of course, the ideal food next to the healthy mother's milk. It is slightly expensive, but if one takes into consideration the expenses of an ailing infant, medicinal and otherwise, this becomes insignificant. This laboratory method has the great advantages of being exact and of being changeable from day to day until the requisite percentage has been secured. Since these institutions are only found in the large centres, the cream mixtures such as I have discussed must suffice for the great mass of the population. With a little care in securing milk from a good, clean source, twice daily, as soon as possible after milking, and at once mixing and sterilizing, little difficulty will be experienced. If the mixture constipates, increase the cream; if it gives rise to colic, etc., and curd passes, dilute with more water. Always use milk-sugar, as certain fermentations occur in solution of cane-sugar which are not possible in milk-sugar.

How much should the child have and how many meals a day? Taking as our standard the healthy nursing child, we easily arrive at the number of meals. It should be fed in the first weeks every two hours between six A.M. and ten P.M. and once at night.

Turning to the digestive organs of the young infant, we find the answer to the first part of our query.

The infant's stomach at birth holds one ounce and quickly enlarges, until at six months it will hold six ounces. At six months the number of feedings will have been reduced to six in the day and the meal increased to six ounces.

The infant had better have this food out of a bottle, flask-shaped preferable, without angles, so that it may be thoroughly cleansed, a rubber nipple fitting over the neck of the bottle. There should be a

double supply of bottles and nipples and the most thorough cleansing should be secured. Attachments, such as long tubes, should not be permitted. It is impossible to cleanse them, and, moreover, with such a bottle the child can feed himself, doing away with the regularity in feeding so essential.

How long shall the child be kept on this food? Until he has several teeth. Then he may have, in addition to milk, a bit of meat to suck at, or a crust of bread with plenty of good butter, or a crust in dish gravy, but still his diet should consist of milk chiefly, avoiding excess of starchy food, such as oatmeal, corn-starch, potatoes, biscuits, arrowroot, etc. Infants take fats well, but have limited digestion for starchy foods. The infant's mother's milk is rich in fat-sugar, but contains no trace of starch.

I have discussed the only infant's food, good, fresh milk, modified so as to meet the requirements of the infant's digestion. It contains everything that he requires. If properly adapted and in sufficient quantity, the child will increase in weight and have the necessary amount of undisturbed sleep.

I said the only food. It is true the manufacturing chemists have for many years been endeavoring to take to themselves the function of providing food for infants. These efforts have resulted in the production of a great many absurdities. Unfortunately for the child, the manufacturers must have something which they can box up and store or ship to great distances. Accordingly we find their wares to consist of condensed milk with sugar or condensed milk and sugar combined with some form of starch. That one should prefer ancient condensed milk, having fresh pure milk at hand and the means of modifying it, or should consider starch a suitable substance to place in the infant's food, seeing that the mother's milk contains no trace of it, may be intelligible from the stand-point of the manufacturer, but is utterly incomprehensible to any one else.